1. Apply the method from class that decides $E_{DFA}$ to the following DFA and answer the questions below.

(a) List the states you mark in the order they get marked.

(b) Does the DFA belong to $E_{DFA}$? ______

(c) How does your answer to (b) follow from your answer to (a)?

2. Apply the method from class that decides $E_{CFG}$ to the following CFG and answer the questions below.

$$S \rightarrow Vax | aSb$$
\[
\begin{align*}
T & \rightarrow aUTS \\
U & \rightarrow aT\mid bU \\
V & \rightarrow YV\mid WX \\
W & \rightarrow YS\mid Xb \\
X & \rightarrow bX\mid a \\
Y & \rightarrow \varepsilon\mid Ya
\end{align*}
\]

(a) List the terminals and variables you mark in the order they get marked. (List each terminal and variable only the first time you mark it. There is more than one possible order.)

(b) Does the CFG belong to $E_{CFG}$? ___________

(c) How does your answer to (b) follow from your answer to (a)?

3. The language $EQ_{REX}$ is defined as \{\langle R, S \rangle | R, S \text{ are regular expressions and } L(R) = L(S)\}. Prove that $EQ_{REX}$ is decidable.

4. Problem 4.3.

5. Let $F = \{\langle A, B \rangle | A, B \text{ are DFAs and } L(A) \subseteq L(B)\}$. Prove that $F$ is decidable.

6. Let $K = \{\langle A \rangle | A \text{ is a DFA and } L(A) \text{ contains a string with one more } a \text{ than } b\}$. Show that $K$ is decidable. (The solution to Problem 4.25 [4.23] is useful here.)

7. Let $L = \{\langle G \rangle | G \text{ is a CFG and } L(G) \text{ contains at least one even length string}\}$. Prove that $L$ is decidable.

8. Show that the set that consists of all finite sequences of natural numbers is countable. In other words show that

\[
\{s | \text{for some } n \geq 0 \text{ and natural numbers } a_1, \ldots, a_n, s = \langle a_1, \ldots, a_n \rangle\}
\]

is a countable set.